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CLAIMS

1. An SPR sensor comprising:

a thin conducting layer comprising at least one conductive element formed on a surface of a transparent substrate;

an illumination system controllable to illuminate an interface between the conducting layer and the substrate;

a photosensitive surface that generates signals responsive to light from the light source that is reflected from a region of the interface;

a flow cell formed with at least one flow channel having a lumen defined by a wall at least a portion of which is formed from an elastic material and a portion of which is formed by a region of the conducting layer; and

at least one hollow needle having an exit orifice communicating with the needle's lumen and wherein fluid flow is enabled between the flow channel and the needle's lumen by puncturing the elastic material with the at least one needle so that the exit orifice communicates with the flow channel lumen.

2. An SPR sensor according to claim 1 wherein the flows cell is produced from of an elastic material.

3. An SPR sensor according to claim 1 wherein the flow cell is formed from a relatively non-elastic material having an insert formed from an elastic material and wherein material of the insert forms at least a portion of the wall of the at least one flow channel.

4. An SPR sensor according to any of claims 1-3 wherein the end of the needle is closed and the exit orifice is located along the length of the needle.

5. An SPR sensor according to any of claims 1-4 wherein when the needle protrudes into the channel it at least partially blocks flow of a fluid from a portion of the channel upstream of the needle to a portion of the needle downstream of the needle.

6. An SPR sensor according to claim 5 wherein when the needle protrudes into the channel, the needle blocks substantially all fluid flow from the upstream portion to the downstream portion of the channel.

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7. An SPR sensor according to any of claims 1-6 wherein the needle is formed with a depression in the needle wall and wherein when the needle protrudes into the channel the depression forms a shunt channel between the upstream portion of the channel and another channel and at least a portion of a liquid flowing from the upstream portion of the channel towards the downstream portion is shunted through the shunt channel to the other channel.

8. An SPR sensor according to any of claims 1-7 wherein upon extraction of the needle a sufficient distance from the elastic material a hole made in the elastic material as a result of the puncturing seals.

9. An SPR sensor according to any of claims 1-8 wherein the at least one needle comprises at least two needles for a channel of the at least one channel and to cause a fluid to flow in the channel both needles puncture the elastic material and are positioned to protrude into the channel with their respective orifices communicating with the channel lumen so that fluid may be pumped into the channel via one of the needles and aspirated from the channel via the other of the needles.

10. An SPR sensor according to claim 9 wherein the channel is a blind channel having neither an inlet or outlet orifice.

11. An SPR sensor according to any of claims 1-10 and comprising a fluid pump coupled to the at least one needle controllable to pump fluid into the needle and thereby, when the needle orifice communicates with the flow channel lumen, into the flow channel.

12. An SPR sensor according to any of claims 1-11 and comprising a fluid pump coupled to the at least one needle controllable to aspirate fluid from the needle and thereby, when the needle orifice communicates with the flow channel, from the flow channel.

13. An SPR sensor according to any of claims 1-12 wherein the illumination system comprises:

an array of light sources;

a collimator that directs light from each light source in a collimated beam of light that enters the substrate and is incident on a region of the interface between the substrate and

conducting layer region that forms the wall portion of each of the at least one flow channel; and

a light source controller controllable to turn off and turn on a light source in the array independent of the other light sources in the array.

14. An SPR sensor comprising:

a thin conducting layer comprising at least one conductive element formed on a surface of a transparent substrate;

a flow cell formed with at least one flow channel having a lumen defined by a wall a portion of which is formed by a region the conducting layer;

a photosensitive surface that generates signals responsive to light reflected from a region of the interface between the region of the conducting layer that forms the wall portion of each of the at least one flow channel and the substrate; and

an illumination system comprising:

an array of light sources;

a collimator that directs light from each light source in a collimated beam of substantially parallel light rays that enters the substrate and is incident on a region of the interface between the substrate and conducting layer region that forms the wall portion of each of the at least one flow channel; and

a light source controller controllable to turn off and turn on a light source in the array independent of the other light sources in the array.

15. An SPR sensor according to claim 13 or claim 14 wherein the array is a linear array having an array axis.

16. An SPR sensor according to claim 15 wherein the axis of the array and a normal to the interface are substantially coplanar.

17. An SPR sensor according to claim 15 wherein the axis of the array and the normal are substantially perpendicular.

18. An SPR sensor according to claim 14 wherein the array is a two dimensional array.

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19. An SPR sensor according to claim 18 wherein the array comprises rows and columns of light sources.

20. An SPR sensor according to claim 19 wherein each column is substantially coplanar with a normal to the interface.

21. An SPR sensor according to claim 19 or claim 20 wherein each row is substantially perpendicular to the normal.

22. An SPR sensor according to any of claims 19-21 wherein light sources in a same column provide light at substantially same wavelengths.

23. An SPR sensor according to any of claims 18-22 wherein all the light sources in the array provide light at substantially same wavelengths.

24. An SPR sensor according to any of claims 19-23 wherein light sources in a same row provide light at different wavelengths.

25. An SPR sensor according to any of claims 14-24 and comprising an optical element having two parallel surfaces through which light from each light sources passes before it is incident on the interface and wherein the optical element is rotatable about an axis perpendicular to the normal so as to change an angle at which light from a given light source is incident on the interface.

26. An SPR sensor according to any of claims 1-25 wherein the at least one conductive element comprises a plurality of conductive elements.

27. An SPR sensor comprising:

a thin conducting layer comprising a plurality of conducting elements formed on a surface of a transparent substrate;

an illumination system controllable to illuminate an interface between the conducting layer and the substrate;

a photosensitive surface that generates signals responsive to light from the light source that is reflected from a region of the interface; and

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a flow cell formed with at least one flow channel having a lumen defined by a wall, portions of which are formed by regions of at least two of the conducting elements.

28. An SPR sensor according to claim 26 or claim 27 wherein each conductive element is connected to a power source controllable to electrify the conducting element with respect to a reference electrode.

29. An SPR sensor according to claim 28 wherein the plurality of conductive elements comprises a plurality of conducting strips.

30. An SPR sensor according to claim 29 wherein each of the at least one flow channel crosses over each conducting strip.

31. An SPR sensor according to claim 28 wherein the plurality of conductive elements comprises a plurality of conducting pixels.

32. An SPR sensor according to claim 31 wherein each of the at least one flow channel passes over at least one conducing pixel and each pixel lies under a flow channel.

33. An SPR sensor according to any of claims 28-32 and comprising an exclusive reference electrode for each conducting element relative to which the conducting element is electrified.

34. An SPR sensor according to any of claims 28-32 wherein all the conducting element are electrified relative to a same reference electrode.

35. An SPR sensor according to claim 33 or claim 34 wherein the reference electrode is located on an external surface of the flow cell.

36. An SPR sensor according to claim 33 or claim 34 wherein the reference electrode is located inside the material from which the flow cell is formed.

37. An SPR sensor according to claim 33 or claim 34 wherein the reference electrode is located on the surface of the substrate.

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38. An SPR sensor according to claim 37 wherein the reference electrode is comb shaped having parallel conducting teeth connected to a common backbone.

39. An SPR sensor according to claim 38 wherein the conductive elements are located between the conducting teeth.

40. An SPR sensor according to any of claims 1-39 wherein the at least one flow channel has a cross section area less than or equal to about a square millimeter.

41. An SPR sensor according to any of claims 1-39 wherein the at least one flow channel has a cross section area less than or equal to about 0.5 square millimeters.

42. An SPR sensor according to any of claims 1-39 wherein the at least one flow channel has a cross section area less than or equal to about 0.2 square millimeters.

43. An SPR sensor according to any of claims 1-39 wherein the at least one flow channel has a cross section area less than or equal to about 0.1 square millimeters.

44. An SPR sensor according to any of claims 1-43 wherein the at least one flow channel comprises a plurality of channels.